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Dr. P. S. B. R. JAMES
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SHRIMP FARMING BY PRIVATE ENTERPRISE- A CASE STUDY

S. Felix, N. Sukumaran, G. Jegatheesan and R. Sundrarajan
Fisheries College, Tamil Nadu Agricultural University, Tuticorin-628 008.

ABSTRACT

In view of the encouraging results shown by the research organisations of India and other countries in prawn culture on scientific methods, a commercial research and development project on prawn culture was established by the TATA Oil Mills Co. Ltd., at Pulicat. Experiments were conducted in earthern ponds of size ranging from 0.4 to 1.25 ha. Stocking rates ranging from 6.5 to 15 prawns/m² were attempted and production to the tune of 0.5 to 1.0 tonne/ha/crop was achieved. Survival rate over 80% could be maintained in all the crops. An artificial feed formulated with shrimp meal, trash fish and vitamin mineral mix along with other usual ingredients, with a protein content of 40%, proved to be better than the other conventional feed. Effect of design of a pond, aging of pond, stocking density, stocking size and various hydrobiological parameters viz. salinity, dissolved oxygen and pH were also studied. The intensive stocking rate, the successful feed formula and the effective water managements adopted were the important reasons for the successful production of shrimps in this farm. The cost of production of 1 kg of shrimps considering the variable cost, varied from Rs. 20.00 to 34.00 and thus a net revenue of Rs. 8000.00 to 20,000.00/ha/crop was achieved.

INTRODUCTION

Though traditional methods of prawn culture were known for years in the *Pokkali* fields of Kerala and the *Bheries* of West Bengal, the scientific way of culture till recently has not been attempted on a commercial scale. During the last decade significent achievements have been made in prawn farming in many parts of the world as they fetched very high price when sold as luxury food (Wickens, 1976). With continuous exploitation of wild prawn resources in India, the marine landings have come down. Hence considerable importance has been recently given towards scientific prawn farming and expanding the area of culture in brackishwater areas.

Though a number of private entrepreneurs have taken up shrimp farming, most of them are not fully aware of the technology of intensive prawn farming, perhaps due to nonavailability of adequate demonstration ponds. Many Government Institutions including the Central Marine Fisheries Research Institute, Central Institute of Fisheries Education, Marine Products Export Development Authority and State Fisheries Departments which have involved themselves in generating and disseminating prawn culture technology also face considerable constraint such as non-availability of seeds and a policy for the allotment of cultivable areas for culture. The coastal people are not financially sound to take up the capital intensive but rewarding culture practice. Though these are some of the general problems on the way for the development of prawn farming in the country as a whole, there are certain specific problems in prawn farming based on the local environmental conditions. The low tidal amplitude prevailing in Tamil Nadu coast is one such problem for example. Thus there is urgent need for developing suitable technical know-how based on our ecological conditions. Keeping these aspects in mind, an attempt was made by TATA OIL MILLS CO. LTD., at Pulicat for standardising the technique for commercial shrimp production.

MATERIALS AND METHODS

The farm is located 60 km north east of Madras city on the western bank of Pulicat

Table 1. *Stocking rate, size, survival and shrimp production in experiments on the culture of* Penaeus indicus *along with the mean hydrobiological parameters.*

Sl. No.	Pond size	Stocking rate (Nos/m²)	Duration (days)	Size at harvest (g)	Survival (%)	Production (kg/ha)	Hydrobiological parameters		
							Salinity (ppt)	Do (ppm)	pH
1.	1.25	5.5	110	12.3	81.0	548	34.0-40.5	2.42-5 2	7.9-8.2
2.	1.26	7·2	110	11.8	83.1	706	18.6-38.0	2.31-4.0	7.9-8.3
3.	0.40	7.5	115	10.6	80.4	637	20.2-38.5	2.00-4.50	7.8-8.2
4.	0.80	7.5	110	12.1	84.0	762	20.0-36.0	2.6-5.0	8.0-8 2
5.	0.40	10.0	110	11.2	93.7	1050	20.5-38.0	3.4-4.3	8.0-8.3
6.	0.50	15.0	120	7.0	85.0	892	28.7-.40.0	2.0-5.0	8 0-8.1

Hydrobiological data were obtained from water samples collected prior to 0700 hours.

lake. The hydrological parameters of this lake are influenced by the adjacent sea and the Buckingham Canal running parallel to the lake which pours in appreciable amount of freshwater into the system during rainy season. The farm has a total area of 13.3 ha of which water spread area is 7.5 ha comprising of 5 nursery ponds and 10 rearing ponds. The size of the rearing ponds was varying from 0.4 to 1.25 ha. Since tidal influence was appreciably low, pumps were used for watering the ponds. The dimentions of the ponds are given in Table 1. The bundhs were turfed with grass to prevent erosion. A diagonal trench of 3' width and 2' depth was excavated across the pond upto the collection box near the outlet. The outlet was guarded by a net shutter and a wooden shutter. The water, pumped from the lake was filtered at several points using Velon screen nets (40 P) before reaching the culture ponds. The nursery ponds were provided with sprinklers for effective aeration as they had more stock of juvenile prawns (100 to 150 nos/m²) all the time. Cowdung at the rate of 500 to 1000 kg/ha and diammonium phosphate (18:46:0) at the rate of 100 kg/ha were applied to the culture ponds for promoting the development of natural feed. A minimum depth of 80 cm water was thereafter maintained in all the ponds throughout the culture period.

Postlarval stages of white prawns, *Penaeus indicus* collected from the lake were conditioned and fed in the nurseries for a couple of weeks. The rearing ponds were stocked with these juveniles of almost uniform size (30-35 mm) at various stocking densities ranging from 55,000 to 1,50,000/ha. They were fed with pelleted feeds, having 40% crude protein, made out of ricebran (30%), groundnut oil cake (20%), tapioca flour (9%) fish meal/trash fish (20%), shrimp head powder (20%), and vitamin mineral mix (1%). The feed pallets were placed in feeding trays fixed at various points along the sides of the pond. The prawns were fed daily at the rate of 20% of their body weight for the first 30 days, 10% for the next 30 days and 5% for the remaining culture period. Prawn were also fed with fresh clam meat once in a week depending on availability. Fortnightly sampling was done in the ponds to assess the population and to observe the growth rate of the prawns. Hydrobiological parameters viz. temperature, salinity, pH and dissolved oxygen levels were monitored daily (A.P.H.A. 1965). After 30 days of culture, the pond water was flushed frequently to improve its quality.

RESULTS AND DISCUSSION

The details of stocking density, average size of prawns at harvest, prawn production

Table 2. *Operation cost of shrimp culture for one hectare area*

Sl. No.	Stocking rate (Nos./m²)	Seed cost (Rs.)	Feed cost (Rs.)	Fuel cost (Rs.)	Miscellaneous (Rs.)	Total cost (Rs.)	Cost of production (Rs./kg)	Net Revenue (Rs.)
1.	5.5	2200.00	6720.00	3600.00	1000.00	13520.00	24.67	8400.00
2.	7.2	2764.00	7680.00	3600.00	1000.00	15044.00	21.36	13116.00
3.	7.5	3000.00	9085.00	4285.00	1000.00	17370.00	27.27	8110 00
4.	7.5	3000.00	9150.00	4500.00	1000.00	17650.00	23 16	12830.00
5.	10.0	4000.00	12375.00	4500.00	1000.00	21875.00	20.83	20125.00
6.	15.0	6000.00	18420.00	4500.00	1000.00	29920.00	34.23	5040.00

along with some important hydrobiological characters are presented in table 1. The values of cost analysis of each crop are given in table 2. It is observed from the table 1, that among the various stocking densities in this study, the crop with 10 prawns/m² density gave the maximum production of prawn (1050 kg/ha/crop), whereas the pond stocked with the lowest density of 5.5/m² exhibited the least production of 548 kg/ha. The highest production recorded coincided with the highest survival rate of 93.7% and the lowest production was recorded in the pond with least survival of 81.0% and lowest stocking. However, the average weight at harvest was found to be more (12.3 g) in culture pond stocked with the lowest density of 5.5 prawns/m². The lowest average size of 7g was recorded in the pond with the highest stocking density (15/m²) due to over stocking. This is also supported by the fact that without aerating devices, the stocking density in natural ponds cannot be increased beyond 10 prawns/m² as observed by Muthu *et al* (1982). In countries like Japan, Taiwan and Korea, stocking densities of 15-20 prawns/m² are being tried and production to the tune of 2-3 tonnes/ha are generally obtained from aerated culture ponds indicating the importance of water quality management in pond culture systems. Stocking densities to the tune of 5 to 15 prawns/m² were attempted in the present study. Accordingly effective water management practices were adopted and hence higher survival rate (about 80%) and better production of shrimps could be obtained.

Provisions of an adequate and inexpensive artificial diet which ensures faster growth and greater survival has been advocated for successful production of shrimps. In the present study the ingredients of both animal and plant origin supplemented with vitamin mineral mix were used for feeding. Besides, the prawn shell meal incorporated in the feed resulted in positive growth enhancement and improved food coversion. It also adds to the palatabitity of the feed. The ingredient as a protein source is said to increase the efficiency of the diets; in fact even 25-35% protein levels have given good results in *P. japonicus* (Balazs *et al.*, 1973). Similar observations have also been made by Indian workers in penaeid prawns confirming the value of prawn shell meal in the palleted feeds. (Ahamed Ali, 1982; Ahamed Ali and Mohamed, 1982; Ahamed Ali and Sivadas, 1983) With the inclusion of prawn shell meal as one of the components in the preparation of the pellets, the cost of production of feed was kept below Rs. 3.25/kg. Thus, in the preparation of the feed, the low cost and the abudantly available prawn shell

meal can be incorporated in the preparation of shrimp feed.

Growth and survival which together determine the ultimate yield of shrimps are generally influenced by a number of ecological parameters controlled by managerial practices. Salinity is considered to be one of the major ecological factors for brackishwater prawns because any drastic change in this parameter could adversely affect the growth of the penaeid prawns. (Subrahmanyam, 1973; Liao, 1977 and Chakraborti *et al.*, 1985). It is observed from this study that the salinity range between 20 to 30 ppt enables faster growth rate of the white prawn, *Penaeus indicus*.

The second primary factor which influences the survival and growth of shrimps is oxygen in the water. The survival of penaeid prawns in the rearing ponds mainly depends on the maintenance of optimum oxygen level (Varghese, 1980). In the brackishwater ponds temperature, salinity and photosynthetic activity generally influence the O_2 content. It was found from this study that oxygen level has to be maintained in the ponds above 2 ppm to have good harvest of prawns. This level may be considered as a minimum below which shrimps may be adversely affected. Hence, a regular exchange of at least one fourth of the pond water during the later phase of culture period is inevitable.

The economics worked out for the crops revealed that the feed cost accounted for about 50-60% of the total variable cost. The fuel cost however showed about half of the feed cost ranging from 15-25%. it is interesting to observe that the pond which was stocked at the rate of 10 prawns/m^2 showed the lowest cost of production (Rs 20.83). Though the yield obtained from 15/m^2 experiment was fairly good (892 kg/ha) the cost incurred to produce a kilogram of prawn was very high (Rs. 34.23) possibly due to the highest cost incurred towards feed. The stocking densities between 7.5 to 10 prawns/m^2 were found to be ideal from the economic point of view. The net revenue obtained from the crop of 15/m^2 was the minimum (Rs. 5040.00) whereas from the other crops net revenue achieved were from Rs. 8100 to 20,125. The cost of production also varied between Rs. 20.00 to 27.00/kg in all the crops except the crop where the highest stocking density was tried.

The results obtained from this TOMCO Prawn Culture Farm has thus proved the possibility of generating economically gainful farming practice even in areas where the expected tidal amplitude is not experienced Similar programmes of culture using pumps for letting in water to the ponds have also been practiced in a few areas in Tuticorin and rewarding productions have been achieved. Since this technology for shrimp farming has been field tested in TOMCO it could be taken up by other small scale private entrepreneure. Depending on the area of culture and the availability of natural seeds, the profit percentage can be considerably enhanced. Newer techniques can also be developed to make use of the reservoirs used in salt production industries for prawn farming. Such attempts based on case studies will open new ways for increasing the prawn culture area in the state.

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